

# But This Goes to 11...

Welcome to the world of bass rigs.

**A**fter a diversion last month into why halfway up on the volume knob doesn't equal half power, we return to the inner workings of our practice combo. We left it with the power amp stage pushing out a high-voltage signal with the ability to support sufficient current to get a decent amount of power (remember power equals voltage times current).

Somehow the loudspeaker in our combo manages to turn this electricity into pressure changes in the air, in other words audible sound. So how does it do this? Our speaker is made up of four key parts: the voice coil, which is a tightly wound wire coil through which electricity flows; the magnet structure, which consists of a powerful magnet plus some shaped pole pieces that direct its magnetic field across the voice coil; the cone, which is a relatively light but stiff paper, polymer, composite or metal membrane which is attached to the voice coil; and finally the suspension, which supports the cone and voice coil. A metal frame that bolts into

the combo's cabinet holds all of this together.

When electricity flows through the voice coil it generates a magnetic field which pushes or pulls against the permanent field between the pole pieces. This causes the voice coil to move forwards or backwards, which thus moves the speaker cone. When the cone moves forwards it compresses the air in front of it, increasing the pressure. When it moves backwards it does the reverse. As sound is a series of pressure changes (hence dB Sound Pressure Level), we hear this compression and rarefaction as sound, and hopefully music (music being organised sound).

For greater SPL we need more intense pressure changes, and to get this we need the speaker to push the air harder by moving further – the distance the speaker moves (at a given frequency) is determined by the voltage pushing it. Double the voltage and the speaker moves twice as far. If you read the previous columns (and were concentrating!), you may have noticed that when you double the

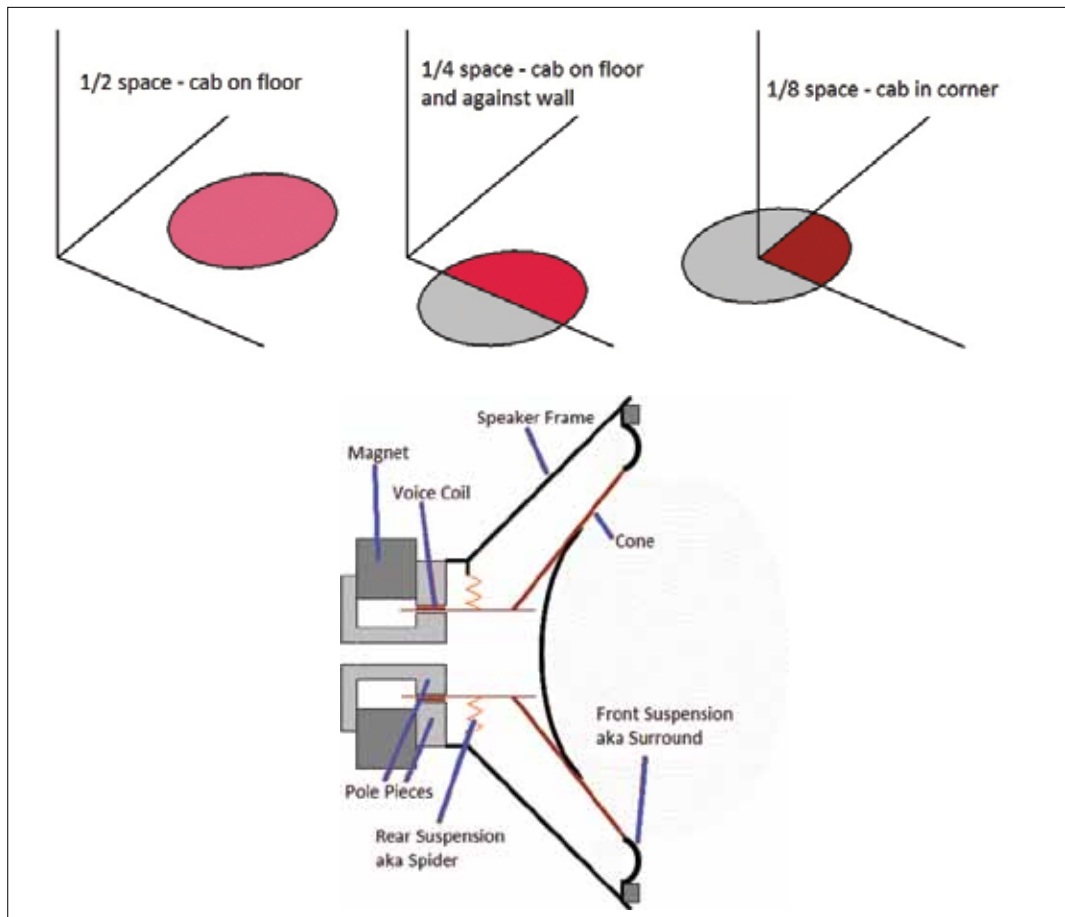
voltage you quadruple the power, because  $P = V^2/R$ . So when you put four times as much power in, the speaker moves twice as far and you get 6 dB more SPL out. If you put ten times as much power in, the speaker moves  $\sqrt{10}$  times as far and you get 10 dB more SPL out.

Confusingly, although putting 10x power in gets 10dB more sound out (ie 10x acoustic watts), our ears do not perceive this as ten times as loud – we only hear it as twice as loud. This is one of the fundamental challenges facing bassists – if your guitarist is twice as loud as you and your amp is already at full power, then you will need ten times as much power as you currently have to match him. Sadly, whatever speaker you currently have, it is unlikely to be able to handle all that extra power (whatever the specs say), so you have an expensive problem.

Once our speaker generates a series of pressure changes in the air directly in front of it, these then radiate as a waveform, from the speaker outwards, whose intensity diminishes with distance. One thing

we do have in our favour, though, when playing indoors is that our speaker radiates low frequencies (not low notes, the lower parts of almost all the notes) in all directions, because the sound wave is very large compared to the size of the speaker. So what happens if our combo has a solid wall close behind it? The sound going backwards is reflected and reinforces the sound going forwards. This effectively doubles the power in the lower frequencies, just like boosting the lows and low mids by 3 dB, but without requiring any more from your amp or your speaker. Place the speaker in a corner and you get the side wall and the rear wall reflecting its omnidirectional output, so a total of 6dB of boost in the lower frequencies. This is clearly a most awesome thing – free power! And not just a small amount of free power as a 6dB increase is equivalent to quadrupling your power, like going from 100W to 400W.

Next month we're going to look at wind power in the most old-school sailing-boat sense, and see how that relates to loudspeakers. Prepare to have many myths debunked!



## About The Author C. ALEXANDER CLABER

Alex first picked up a bass when studying engineering at university, and his quest for sonic perfection led him to found Barefaced Audio, while also leading The Reluctant,

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